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CIRCULAR NO. 14, SECOND SERIES. (REVISION OF NO. 6.)

United States Department of Agriculture.

DIVISION OF ENTOMOLOGY

THE MEXICAN COTTON-BOLL WEEVIL.

(*Anthonomus grandis* Boh.)

SCOPE OF THE CIRCULAR.

Circular No. 6 was published in April, 1895, and contained a brief report of the observations made up to that time, and the conclusions based on those observations, concerning the Mexican cotton-boll weevil, an insect of Central American origin which, during 1894, attracted considerable attention in the cotton fields of south Texas. The investigation was continued during the summer, fall, and early winter of 1895, especially by Mr. Schwarz, who visited Texas in May and June and again from October to December, and by Mr. Townsend, who was stationed in the State during the greater part of the summer. The writer went to Texas in December, and in company with Mr. Schwarz carefully studied the condition of affairs at that season and talked with many prominent cotton growers. The object of the present circular is to lay before cotton planters the results of this supplementary investigation. In order to make it complete in itself, such facts as are needed are repeated from Circular No. 6.

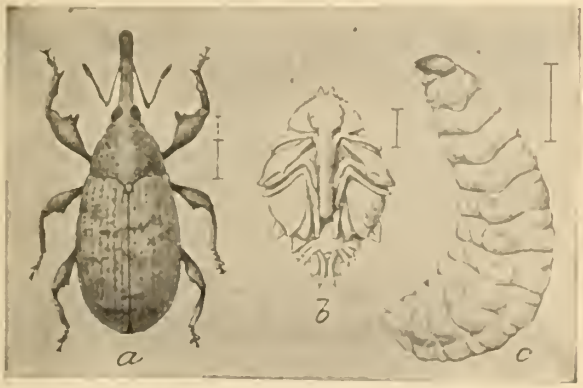

FIG. 1.—*Anthonomus grandis*: *a*, adult beetle; *b*, pupa; *c*, larva—all enlarged.

GENERAL APPEARANCE AND METHOD OF WORK.

This insect is a small, grayish weevil, of the shape and general appearance shown in fig. 1, *a*, and measuring a little less than a quarter of an inch in length. It is found in the cotton fields throughout the season, puncturing and laying its eggs in the squares and bolls. The larvæ, of the shape and appearance shown at fig. 1, *c*, and measur-

ing a little over three-eighths of an inch in length when full grown, live within the buds and bolls and feed upon their interior substance. The squares attacked usually drop, but most of the damaged bolls remain upon the plant and become stunted or dwarfed, except late in the season, when they either dry or rot.

DISTRIBUTION.

This insect through its ravages caused the abandonment of cotton culture around Monclova, Mexico, about 1862. Two or three years ago

FIG. 2.—Map showing distribution of the Mexican cotton-boll weevil.

cotton was again planted in that vicinity, but the weevil immediately reappeared and destroyed the crop. At Matamoras the weevil was noticed eight or ten years ago. About 1893 it crossed the river at Brownsville, and in 1894 was noticed in the country around San Diego, Alice, and Beeville. At the close of the season of 1894 the insect occupied a territory extending to the north a little beyond Beeville, a few miles to the east of that point, and southwest to the neighborhood of Realitos, on the National Mexican Railway. The greatest damage seems to have been done along the lower Nueces River. During 1895, and particularly in the latter part of the season, it extended its range to a considerable extent. Toward the east it was found in moderate

abundance along the valley of the Guadalupe River at Victoria, Thomaston, and Cuero. North of its old range it extended to Kenedy, Floresville, and many points in the country lying between the latter place and Cuero. A single field was found near San Antonio which contained weevils in large numbers, and in the same way a single field was found far to the east at Wharton in which the weevils had appeared late in the season. The exact localities where the insect was found during 1895 are indicated on the accompanying map.

NATURAL HISTORY AND HABITS.

The insect passes the winter in the weevil state. It can be found on the cotton plant until late in December, and, in fact, as long as any portion of the plant is green. It is found most abundantly in the early winter hidden between the involucre and the boll, and later it frequently works its way down into the dry and open bolls. All the specimens found by Mr. Schwarz in such situations in the late spring of 1895 were dead; but Mr. Townsend found a few living in March. The dry boll is probably not a frequently successful hibernating place. Judge S. G. Borden, of Sharpsburg, however, writing under date of January 27, 1896, states that the weevil at that time was being found nearly every day in the dry bolls; but this statement lacks the significance which it might otherwise have had as bearing on the question of hibernation from the fact that no heavy frost had probably occurred up to that time at Sharpsburg.

FIG. 3.—*a*, newly hatched larva in young square; *b*, nearly full-grown larva *in situ*; *c*, pupa in young boll picked from ground.

With the cutting of the plants or with the rotting or drying of the bolls as a result of frost, the adult weevils leave the plant and seek shelter under rubbish at the surface of the ground, or among weeds and trash at the margin of the fields. Here they remain until the warm days of spring, when they fly to the first buds on such volunteer plants as may come up in the neighborhood. They feed on these and lay their eggs on the early squares, and one, or perhaps two, generations are developed in such situations, the number depending upon the character of the season and the date of cotton planting. By the time the planted cotton has grown high enough to produce squares the weevils have become more numerous, and those which have developed from the generation on volunteer cotton attack the planted cotton, and through their punctures, either for feeding or egg-laying, cause a wholesale shedding of the young squares. It seems to be an almost invariable rule that a square in which a weevil has laid an egg drops to the ground as a result of the work of the larva; in the square on the ground the larva reaches full growth, transforms to pupa, and issues eventually as a beetle, the time occupied in this round approximating four weeks. Later, as the bolls form, the weevils attack them also and lay their

eggs in them, and the larvæ develop in the interior just as with the squares. The bolls, however, do not drop. Figs. 3, *a*, and 3, *b*, show the larvæ in the squares, and fig. 3, *c*, shows a young boll cut open and the pupa in its customary position.

There is a constant succession of generations from early spring until frost, the weevils becoming constantly more numerous and the larvæ and pupæ as well. A single female will occupy herself with egg-laying for a considerable number of days, so that there arises by July an inextricable confusion of generations, and the insect may be found in the field in all stages at the same time. The bolls, as we have just stated, do not drop as do the squares, but gradually become discolored, usually on one side only, and by the time the larva becomes full-grown generally crack open at the tip. While in a square one usually finds but a single larva, in a full-grown boll as many as twelve have been found. In any case, however, the hatching of a single larva in a boll results in the destruction of the boll to such an extent that its fiber is useless. Where no serious frost occurs in December, the insects all, or nearly all, reach maturity and enter hibernating quarters, although larvæ have been found on into January at Sharpsburg. Whenever a heavy frost comes in this month, or before, the observations of last fall show that those insects which have not reached the beetle stage are nearly all killed. From this fact it follows that the insect will probably not prove as injurious in other portions of the cotton belt as it is in southern Texas.

FIG. 4.—Mature boll cut open at left, showing full-grown larva; the one at the right not cut and showing feeding punctures and oviposition marks.

It was found during the latter part of 1895 that the weevil was present in a number of localities in which it was not known by the planters themselves to occur. It is important that every planter who lives in or near the region which we have mapped out should be able to discover the weevil as soon as it makes its appearance in his fields. Where a field is at all badly infested the absence of bloom is an indication of the presence of the insect. In the early part of the season the weevils attack the squares first, and these wilt and drop off. A field may be in full blossom, and as soon as the insect spreads well through it hardly a blossom will be seen. This dropping alone, however, is not a sufficient indication of the weevil's presence. Squares are shed from other causes, but if a sufficient number of fallen squares are cut open the cause will be apparent. The characteristic larva of the weevil will be quite readily recognizable on comparison with the figures which we publish herewith.

FIG. 5.—Late fall boll showing how beetles hide between boll and involucre.

As stated above, the bolls do not drop. The punctures made by the weevils in feeding, however, are comparatively characteristic, and where a boll is discolored and has begun to crack at the tip the larva or the pupa can be seen without trouble on cutting it open. Late in the season the weevils themselves will be found between the involucre and the boll, as shown in fig. 5, or in their absence the feeding marks and the yellow, granular excrement which collects in the involucre at the base of the boll are excellent indications.

POPULAR NAMES.

In south Texas, among Spanish-speaking people, the insect is generally known as the "piendo," a descriptive name which refers to the snout or beak of the insect. English speaking planters generally referred to the insect at first, as "the sharpshooter," a term which for many years has been applied to any insect which causes through its punctures the shedding of the squares or the rotting of the bolls. As there are several native insects that are commonly called sharpshooters, and which, though injurious, are by no means to be compared with this insect, it becomes necessary to discourage in every way the use of the word sharpshooter as applied to this weevil. This was attempted in the first edition of the circular by illustrating one of the commonest of the insects ordinarily termed sharpshooters, calling attention to the radical differences which exist between it and the weevil under consideration. The adoption of the term "Mexican cotton boll weevil" for the new pest is recommended. The term sharpshooter is now much less generally applied to the weevil than it was at first. Planters generally now refer to it as the boll weevil, or the Mexican weevil, or the Mexican boll weevil.

PARASITES AND NATURAL ENEMIES.

It is safe to say that little assistance will be derived from the work of natural enemies and parasites upon this insect. Of the former none of any importance have been found. Several parasites, however, have been found to attack it, and in one or two localities some little good has resulted from their work. They have only been abundant, however, late in the season, after the weevil has completed its damage for the year and at a time when a minimum of good can be accomplished by the destruction of the larva. The majority of the weevils in a given field fail to hibernate successfully, being killed by cold weather or some other cause, so that the work of parasites at this time does not count. Careful estimates, however, show that from 15 to 20 per cent of the weevil larvæ in fallen squares in November at Beeville and Kenedy were destroyed by parasites. There is a bare possibility that in the original home of the weevil (south Mexico and some Central American States, as well as certain of the West Indies) more efficacious parasites could be found, but this possibility is hardly sufficiently strong to warrant the expense of a search expedition.

REMEDIES.

In considering the matter of remedies we must start with the statement that experience has shown that none of the general applications of insecticides will be of the slightest value against this species. There are measures, however, which cotton planters may adopt and which, if carried out generally at the right time, will postpone the appearance of

the insect in injurious numbers for one or two generations, even if they will not prevent an undue multiplication of the species. These measures are directed against the over-wintered weevils and the larvæ of the first generation, since where the insect has once become numerous nothing can be done to save the crop from practical destruction.

We have noticed that the weevils first appear in spring among clusters of young squares on the most advanced cotton plants. This suggests the possibility of trapping these earliest beetles by means of a very few cotton plants especially grown for this purpose. These plants must be grown at convenient points, must be protected from frost, and forced by watering, so that they will branch out and acquire buds even in advance of the volunteer cotton. The weevils which issue from hibernating quarters on the first warm days will be attracted to these plants at once, and can be easily collected and killed, if the plants are examined daily until the cotton in the fields has become of some size. It is not likely that this plan will appeal to the average cotton planter, but we are convinced that much good can be done by its general adoption.

The fact that the spring generation develops only upon volunteer cotton has suggested the possibility that the insect will not spread beyond the region where volunteer cotton will grow in spring, but unfortunately this possibility is by no means absolutely to be relied upon. Nevertheless, the destruction of such volunteer plants as come up in corn fields and in abandoned fields which, the previous year, were planted to cotton, can not be too strongly recommended, for it is a matter of observation that the shade afforded by the corn or the rank-growing weeds which come up in abandoned fields is especially favorable to the development of the weevils.

While the plants are young, and where labor is as cheap as it is in south Texas, a great deal of good can be accomplished by picking and burning the fallen squares, and if this is done promptly a large number of the insects will be destroyed. It should be done at least twice, at intervals of three weeks, during the period while the plants are small. As soon as the plants begin to branch out, however, this method becomes impracticable, on account of the difficulty of finding the squares on the ground.

The idea of picking the affected bolls during the cotton picking was suggested in the first edition of the circular. It was thought that the affected bolls could be so readily recognized that many thousands of the insects could be destroyed by the cotton pickers by picking these affected bolls and carrying them away in a separate receptacle to be burned. The amount of extra labor involved in this operation, however, would be very considerable, and the affected bolls in many instances are not to be recognized at a glance.

These measures, aside from the last one, together with early planting and clean cultivation, comprise all that can be done to save the crop of 1896. It is obvious, however, that no general adoption of these simple measures will be brought about this year, and that the probabilities are strong that the insect will be quite as injurious as in 1895, if not more so. A good first crop will probably be secured if the climatic conditions are favorable, but the top crop is sure to be destroyed by the weevils. This destruction, judging from the experience of the past two years, will probably take place in September in most of the localities where the weevils were present in 1895, and at this time the prospective loss of the top crop will at once become evident from the absence of bloom.

The prospect of any further picking of cotton being thus rendered so extremely small, a suggestion is obtained as to what is perhaps, after all, the most practical way of reducing the numbers of the weevil and securing approximate immunity for the summer of 1897, and that is in the cutting down and burning of the plants at a time when it becomes evident that the cotton yet to be gathered will be very small in quantity. In many localities during the past summer this could have been done to very great advantage as early as the beginning of October, and several large growers of cotton in Nueces and Duval counties have decided to undertake this means next year. The success of this measure will naturally depend upon uniformity of action among the planters of a given region, and the difficulty of securing this uniformity is the main argument to be used against it. Only about half the cotton in Duval County, for example, seems to be grown by the proprietors of the land; the remainder is grown by renters, who will be not at all disposed to cut down their plants so long as a chance remains of picking a handful of cotton. In this way the plants in many fields will doubtless be left standing until toward the end of December.

Could anything like uniformity be secured, either by legislation or otherwise, it is in this fall destruction of the cotton that our best hope lies at the present outlook; and in this connection the further suggestion should be made that not all the plants in any given field should be destroyed in this way. All the insects which are in the larval and pupal condition will be destroyed when the cotton is burned, but those which may be in the beetle stage will, by flight, escape alive. If, therefore, a certain number of the plants are left standing in every field, these plants will attract the remaining beetles, which will settle upon them, so that they may readily be collected day after day and destroyed. If the plants are all cut down and burned, the beetles will spread far and wide; but if a few are left standing in this way, the weevils will concentrate upon them in such a way that they can be easily handled. Where there is obviously a certain amount of cotton still to be gathered after the early part of October, it may be an object to postpone this cutting down and burning of the plants. We have found that the weevil continues to breed and may be found in the bolls in all stages up to the time of the first frost. The cutting and burning will then accomplish a considerable amount of good, even if done during November, although October would be far better.

From the present outlook, therefore, the best hope which the cotton planters in the affected region will have for the future will be in following this last-described method in the fall of 1896, and the more thoroughly and uniformly (and, in fact, the earlier) this is done in any given locality the greater will be the chance for a good crop the following year. Unfortunately, after talking with many cotton planters in this region, we are by no means sure that the plan will be at all generally followed, for the reasons suggested above; and as the prospects of these planters themselves, as well as the owners of cotton plantations in adjoining regions as yet uninfested, will depend almost entirely on the general adoption of this plan or some better one which may yet be discovered, it becomes necessary to look forward to the enforcement of remedial work by legislation.

It will be greatly to the interest of all growers of cotton in the prolific district lying to the northeast of the region at present infested to urge the passage of an act during the session of 1896–97 which will bring about the enforcement of remedial work in 1897. This act should pro-

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vide for the appointment of commissioners in each county upon the application of a certain number of the citizens of that county. These commissioners should be empowered to enforce remedial work, to levy penalties, or to have the work done by their own agents, the cost to be assessed upon the property. It will be well to let this law have a wide bearing and not to confine its application to this particular insect, but cover all injurious insects, in case of future emergencies of a similar nature. Such a law should be passed in every State in the Union. Though it might remain inoperative for years, its application would be available in case of any sudden emergency, such as the introduction from a foreign country of a new injurious insect, or the sudden multiplication and spread of any one of our native species.

SUMMARY OF REMEDIES.

(1) Trapping over-wintered beetles by means of a few early planted cotton plants.

(2) Destruction of volunteer plants in corn fields or abandoned fields.

(3) Picking fallen squares as fast as practicable, from the time the squares are formed on the plant.

(4) Cutting and burning the cotton stalks as early in the fall as practicable, and, if possible, plowing the cotton fields at the same time.

(5) Trapping the last weevils in the field by means of a few plants left standing.

There can be no doubt that this insect is the most serious enemy to the cotton plant with which cotton growers in this country have had to contend, and every effort should be made to prevent its further spread. The writer believes that this can be accomplished, if, by concerted action of the planters, the recommendations just made are carried out throughout the infested region.

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Entomologist.

Approved:
CHAS. W. DABNEY, Jr.,
Assistant Secretary.

WASHINGTON, D. C., *February 12, 1896.*

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